

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-067909

(43)Date of publication of application : 08.03.2002

(51)Int.Cl.

B60T 8/00

B60T 8/26

B60T 13/00

B60T 17/18

(21)Application number : 2000-259848

(71)Applicant : TOYOTA MOTOR CORP

DENSO CORP

AISIN SEIKI CO LTD

(22)Date of filing : 29.08.2000

(72)Inventor : YAMAMOTO TAKAYUKI

SAWADA NAOKI

KOJIMA SEIICHI

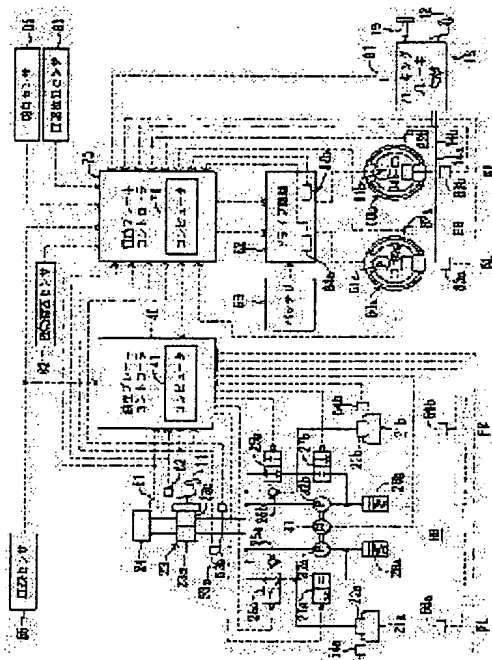
(54) BRAKE CONTROL DEVICE FOR VEHICLE

(57)Abstract:

PROBLEM TO BE SOLVED: To enhance cooperation between a hydraulic brake device and an electric brake device and exact utilization of these brake devices.

SOLUTION: The hydraulic brake device HB is applied to right and left front wheels FR, FL, and the electric brake device EB is applied to right and left rear wheels RR, RL. When malfunction is generated in the hydraulic brake device HB, braking force of the right and left rear wheels RR, RL by the electric brake device EB is increased thereby compensating a shortage of the braking force of the right and left front wheels FR, FL, or generation of an angular moment of the vehicle due to the braking force is restrained by applying the braking force only to the wheels positioned in an diagonal relationship.

Further, when the vehicle is in an extremely low speed running state or stopped state, or a parking brake is in an operating state, the operation of the electric brake device EB is stopped or restrained thereby restraining power consumption.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision
of rejection]

[Date of requesting appeal against examiner's
decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

*** NOTICES ***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. ***** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The brake gear for vehicles characterized by providing the following. The fluid-pressure formula brake gear which gives the damping force by the operation fluid pressure to the wheel which is applied to the wheel which belongs to the 1st group among two or more wheels, and belongs to this 1st group according to brakes operation. The electromotive brake gear which gives the damping force by power to the wheel which is applied to the wheel belonging to the 2nd different group from the 1st group of the above among two or more aforementioned wheels, and belongs to this 2nd group according to brakes operation.

[Claim 2] The brake gear for vehicles characterized by establishing the fluid-pressure-electric proportioning-control means which carries out change control of the distribution with the damping force by the aforementioned fluid-pressure formula brake gear, and the damping force by the aforementioned electromotive brake gear according to the state of vehicles in the brake gear for vehicles indicated to the aforementioned claim 1.

[Claim 3] It is the brake gear for vehicles which is what changes compared with the time of the aforementioned abnormalities not generating distribution with the damping force according to the aforementioned fluid-pressure formula brake gear when abnormalities occur in the grant state of damping force as opposed to [in the brake gear for vehicles indicated to the aforementioned claim 2, the state of the aforementioned vehicles is in the grant state of damping force over the wheel according to brakes operation, and] one of wheels in the aforementioned fluid-pressure-electric proportioning-control means, and the damping force by the aforementioned electromotive brake gear.

[Claim 4] In the brake gear for vehicles indicated to the aforementioned claim 2, two or more aforementioned wheels consist of a front wheel and a rear wheel. The wheel which belongs to the 2nd group of the above while the wheels to which the 1st group of the above belongs are either a front wheel or the rear wheels is another side of a front wheel and the rear wheels. Are related to the size of the damping force required as the state of the aforementioned vehicles according to brakes operation. and the aforementioned fluid-pressure-electric proportioning-control means The brake gear for vehicles which is what changes distribution with the damping force by the aforementioned fluid-pressure formula brake gear, and the damping force by the aforementioned electromotive brake gear according to the size of the damping force by which the demand was carried out [aforementioned].

[Claim 5] It is the brake gear for vehicles which realizes change of distribution of the aforementioned damping force by controlling the damping force according [on the brake gear for vehicles indicated to any one of the aforementioned claim 2 or claims 4, and / the aforementioned fluid-pressure-electric proportioning-control means] to the aforementioned electromotive brake gear.

[Claim 6] In the brake gear for vehicles indicated to the aforementioned claim 1, it is constituted so that one of groups may contain a left wheel and a right wheel, even if there are few 1st groups of the above and 2nd groups. The brake gear for vehicles characterized by establishing a right-and-left proportioning-control means to control the aforementioned fluid-pressure formula brake gear or the aforementioned electromotive brake gear according to the state of vehicles,

and to control distribution of each damping force given to the left wheel belonging to aforementioned one group, and a right wheel.

[Claim 7] It is the brake gear for vehicles which is what changes distribution of each damping force given to the aforementioned left wheel and a right wheel when abnormalities occur in the grant state of damping force as opposed to [the state of the aforementioned vehicles is in the grant state of damping force over the wheel according to brakes operation in the brake gear for vehicles indicated to the aforementioned claim 6, and] the aforementioned wheel in the aforementioned right-and-left proportioning-control means according to the position of the wheel which abnormalities generated in the grant state of the aforementioned damping force.

[Claim 8] It is the brake gear for vehicles which is what changes distribution of the damping force which is made to depend for the aforementioned right-and-left proportioning-control means also on a rolling-stock-run state in the brake gear for vehicles indicated to the aforementioned claim 7, and is given to the aforementioned left wheel and a right wheel.

[Claim 9] In the brake gear for vehicles indicated to any one of the aforementioned claim 6 or claims 8 The 2nd group of the above is constituted so that a left wheel and a right wheel may be included, and the aforementioned electromotive brake gear is constituted from an electric actuator of the couple which gives damping force independently of the aforementioned left wheel and a right wheel. The aforementioned right-and-left proportioning-control means is a brake gear for vehicles which is what realizes change of distribution of the damping force given to the left wheel belonging to the 2nd group of the above, and a right wheel by controlling the electric actuator of the aforementioned couple by different mode.

[Claim 10] The brake gear for vehicles characterized by establishing a halt suppression means to embrace the state of vehicles, and to suspend or suppress the operation of the aforementioned electromotive brake gear in the brake gear for vehicles indicated to the aforementioned claim 1.

[Claim 11] It is the brake gear for vehicles which is what suspends or suppresses the operation of the aforementioned electromotive brake gear when the state of the aforementioned vehicles is the pole low-speed run state or idle state of vehicles in the brake gear for vehicles indicated to the aforementioned claim 10 and the aforementioned halt suppression means has the aforementioned vehicles in a low-speed run state or a idle state very much.

[Claim 12] The aforementioned halt suppression means is a brake gear for vehicles which is what suppresses [which suppresses, and the state of the aforementioned vehicles is an operating state of a parking brake in the brake gear for vehicles indicated to the aforementioned claim 10, and stops] the operation of under the operation of the aforementioned parking brake, and the aforementioned electromotive brake gear.

[Translation done.]

*** NOTICES ***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the brake gear for vehicles which gives damping torque to each ring and brakes vehicles.

[0002]

[Description of the Prior Art] From the former, the hydraulic brake which makes a wheel cylinder a driving source is arranged in the front and rear, right and left ring position of vehicles, respectively, a hydraulic brake is operated with the brake oil pressure supplied to each wheel cylinder according to treading-in operation of a brake pedal, and the twisted brake gear for vehicles which gives the damping force according to brake oil pressure to each ring, respectively is well known as shown, for example in JP,1-164658,A and JP,1-164662,A. Moreover, the electric brake which makes an electrical motor a driving source is arranged in the front and rear, right and left ring position of vehicles, an electric brake is operated by rotating an electrical motor according to treading-in operation of a brake pedal, and the brake gear for vehicles which gave the damping force according to rotation of an electrical motor to each ring, respectively is also well known as shown in recent years, for example, JP,11-43041,A.

[0003]

[Problem(s) to be Solved by the Invention] However, if it is in the brake gear for vehicles of the above-mentioned former, and it has only a hydraulic brake but a fault occurs in a hydraulic system, an operator will sense sense of incongruity between the amount of treading in of a brake pedal, and a feeling of a slowdown at the time of treading-in operation of a brake pedal. If it has only an electric brake but a fault occurs in electric system even if it is in the brake gear for vehicles of the above-mentioned latter, an operator will sense the aforementioned sense of incongruity at the time of treading-in operation of a brake pedal. Moreover, although there was nothing, while it needed the big damping torque for braking a wheel during the vehicles halt by the brake pedal, and big current flowed unnecessary for an electrical motor and power was consumed vainly, it had also become causes, such as generation of heat of an electrical motor, and breakage.

[0004]

[The outline of invention] It was made in order that this invention might cope with the above-mentioned problem, and the purpose is to offer the brake gear for vehicles which aimed at exact use of this fluid-pressure formula brake gear and an electromotive brake gear while offering the brake gear for vehicles aiming at cooperation of a fluid-pressure formula brake gear and an electromotive brake gear.

[0005] In order to attain the aforementioned purpose the constitutional feature of this invention The fluid-pressure formula brake gear which gives the damping force by the operation fluid pressure to the wheel which is applied to the wheel which belongs to the 1st group among two or more wheels, and belongs to this 1st group according to brakes operation, It is applied to the wheel belonging to the 2nd different group from the 1st group of the above among two or more aforementioned wheels, and is in having had the electromotive brake gear which gives the damping force by power to the wheel which belongs to this 2nd group according to brakes

operation. It is good for fluid-pressure actuators, such as a fluid-pressure cylinder, to brake a braking member by pushing against the braked member which rotates a braking member (friction member) with a wheel with electric actuators, such as an electrical motor, if it is in an electromotive brake gear, if it is in a fluid-pressure formula brake gear in this case, and for frictional force with a braked member to brake a wheel.

[0006] In this invention constituted as mentioned above, by having made a different brake gear called a fluid pressure and the electrical and electric equipment intermingled Also at the time of the abnormalities of the fluid-pressure systems at the time of the liquid spill of various piping, and the negative pressure fault of a booster etc. Also at the time of the abnormalities of electric system, such as abnormalities of various sensors, and a fall of battery voltage Vehicles can be stopped now using the damping force of one of systems. That is, vehicles can be stopped now by grant of damping force to the wheel belonging to one group of the 1st and 2nd groups, and while an operator can get the feeling of a slowdown corresponding to brakes operation, rolling-stock-run safety is secured good. Moreover, since a fluid-pressure formula and an electromotive brake gear can brake vehicles, compensating mutual weak points, such as response delay of the fluid-pressure formula brake gears at the time of low temperature etc., they can make the control characteristic of braking good.

[0007] Moreover, in the aforementioned brake gear for vehicles, it is good to establish the fluid-pressure-electric proportioning-control means which carries out change control of the distribution with the damping force by the aforementioned fluid-pressure formula brake gear and the damping force by the aforementioned electromotive brake gear according to the state of vehicles. And it is good to, change distribution with the damping force according [the aforementioned fluid-pressure-electric proportioning-control means] to the aforementioned fluid-pressure formula brake gear and the damping force by the aforementioned electromotive brake gear for example, compared with the time of the aforementioned abnormalities not occurring, when abnormalities occur in the grant state of damping force over a wheel. If distribution of damping force to the wheel which specifically belongs to the 2nd group if abnormalities have occurred in the fluid-pressure formula brake gear was enlarged and abnormalities have occurred in the electromotive brake gear, distribution of damping force to the wheel belonging to the 1st group will be enlarged.

[0008] According to this, as a result of distribution of the damping force of the wheel belonging to the group of another side increasing although the damping force of the wheel belonging to the group of the method of the same decreases if abnormalities occur in the grant of damping force to a wheel in one group of the 1st and 2nd groups, reduction of the damping force of the wheel belonging to aforementioned one group is suppliable with the damping force of the wheel belonging to the group of another side. Therefore, such even case, vehicles can be stopped exactly, and rolling-stock-run stability is secured.

[0009] Moreover, when [for example,] the wheel which belongs to the 2nd group of the above while two or more aforementioned wheels consist of a front wheel and a rear wheel and the wheels to which the 1st group of the above belongs are either a front wheel or the rear wheels is another side of a front wheel and the rear wheels, As for the aforementioned fluid-pressure-electric proportioning-control means, it is good to make it change according to the size of the damping force of which distribution with the damping force by the aforementioned fluid-pressure formula brake gear and the damping force by the aforementioned electromotive brake gear is required according to brakes operation. According to this, distribution of the damping force of a front wheel and a rear wheel can be brought close to ideal distribution, and can be controlled now, the lock of a wheel, especially the lock of a rear wheel can be avoided, and rolling-stock-run stability can be secured. Moreover, since ideal distribution of the aforementioned damping force changes in this case according to the load of a vehicles order ring, it is good to detect the load over a rear wheel and to determine distribution of the aforementioned damping force also in consideration of this load.

[0010] Moreover, when controlling distribution with the damping force of the wheel which belongs to the 1st group as mentioned above, and the damping force of the wheel belonging to the 2nd group (i.e., when controlling distribution with the damping force by the fluid-pressure formula

brake gear, and the damping force by the electromotive brake gear), it is good to control the damping force of the wheel belonging to the 2nd group, i.e., the damping force by the electromotive brake gear. Since it is easy to control an electromotive brake gear electrically compared with controlling a fluid-pressure formula brake gear electrically, distribution with the damping force of the wheel belonging to the 1st group and the damping force of the wheel belonging to the 2nd group can control easily.

[0011] Moreover, while applying a fluid-pressure formula brake gear to the wheel belonging to the 1st group In the brake gear for vehicles which applied the electromotive brake gear to the wheel belonging to the 2nd group Are constituted so that one of groups may contain a left wheel and a right wheel, even if there are few 1st groups of the above and 2nd groups, and the aforementioned fluid-pressure formula brake gear or the aforementioned electromotive brake gear is controlled according to the state of vehicles. It is good to establish a right-and-left proportioning-control means to control distribution of each damping force given to the left wheel belonging to aforementioned one group and a right wheel. When abnormalities generate the aforementioned right-and-left proportioning-control means in the grant state of damping force over the aforementioned wheel in this case, it is good to change into the grant state of the aforementioned damping force distribution of the damping force given to the aforementioned left wheel and a right wheel according to the position of the wheel which abnormalities generated.

[0012] damping force grant of as opposed to [according to this] one wheel -- abnormalities -- generating -- said -- the right and left which these abnormalities generated when the damping force of only one wheel was insufficient -- it is controllable to make the damping force to one wheel of the same side increase from the damping force to one wheel of a right-and-left opposite side Consequently, the angular moment of the vehicles by damping force grant imbalanced to a longitudinal direction can be suppressed, and vehicles can be stopped where rolling-stock-run stability is secured.

[0013] Moreover, it is good to change distribution of the damping force which is made to depend for the aforementioned right-and-left proportioning-control means also on a rolling-stock-run state in addition to the above, and is given to the aforementioned left wheel and a right wheel. As a rolling-stock-run quantity of state, it is the vehicle speed, a steering angle, etc., for example, and, thereby, distribution of the damping force given to the aforementioned left wheel and a right wheel is determined depending on rolling-stock-run speed, a revolution state, etc. Consequently, vehicles can be stopped where rolling-stock-run stability is secured better.

[0014] Moreover, when it is constituted so that the 2nd group of the above may contain a left wheel and a right wheel, the aforementioned electromotive brake gear is constituted from an electric actuator of the couple which gives damping force independently of a left wheel and a right wheel, and the aforementioned right-and-left proportioning-control means should just control a pair of same electric actuator by different mode. Since what is necessary is just to control an electric actuator electrically also in this case, distribution of the damping force of a left wheel and a right wheel can control easily.

[0015] Moreover, while applying a fluid-pressure formula brake gear to the wheel belonging to the 1st group, in the brake gear for vehicles which applied the electromotive brake gear to the wheel belonging to the 2nd group, it is good to establish a halt suppression means to embrace the state of vehicles, and to suspend or suppress the operation of the aforementioned electromotive brake gear. When vehicles are in a low-speed run state or a idle state very much in this case, or when a parking brake is in an operating state, it is good to suspend or suppress the operation of the aforementioned electromotive brake gear.

[0016] According to this, although big damping force is unnecessary, since the operation of an electromotive brake gear is suspended or suppressed when under the pole low-speed runs at the time of traffic congestion etc. or a parking brake is operating, generation of heat of the electromotive brake gear by continuation energization, breakage, consumption of useless power, etc. can be prevented during a halt of the vehicles for which grant of prolonged damping force may be needed.

[0017]

[Embodiments of the Invention] Hereafter, if the operation form of this invention is explained

using a drawing, drawing 1 shows roughly the whole brake gear for vehicles concerning this operation form.

[0018] This brake gear for vehicles consists of fluid-pressure formula brake gear HB for giving damping force to the right-and-left front wheels floor line and FR, and an electromotive brake gear EB for giving damping force to the right-and-left rear wheels RL and RR. Moreover, this brake gear for vehicles is equipped with the brake pedal 11 as a brakes operation member for service brakes, and the parking pedal 12 as a brakes operation member for parking brakes. If a brake pedal 11 is operated, fluid-pressure formula brake gear HB and electromotive brake gear EB will operate, and the damping force corresponding to the control input (or operating physical force) F of this pedal 11 will be given to the right-and-left front wheels floor line and FR and the right-and-left rear wheels RL and RR. In addition, this brake pedal 11 is energized by the criteria position with the spring which is not illustrated.

[0019] If the parking pedal 12 is operated, electromotive brake gear EB operates, and the damping force corresponding to the control input (or operating physical force) of this pedal 12 will be given to the right-and-left rear wheels RL and RR, and it will be maintained. However, grant of the damping force corresponding to operation of this parking pedal 12 is not necessarily controlled electrically, and is controlled by the mechanical hauling force through the parking brake cables 14a and 14b by the parking-brake mechanism 13 in which this pedal 12 was attached. The release lever 15 is also attached to the parking-brake mechanism 13, operation of the aforementioned parking pedal 12 is canceled by operation of this lever 15, and the damping force of the aforementioned right-and-left rear wheels RL and RR is also canceled.

[0020] Fluid-pressure formula brake gear HB is equipped with the hydraulic brakes 21a and 21b for giving damping force to the right-and-left front wheels floor line and FR, respectively. These hydraulic brakes 21a and 21b suppress rotation of a wheel by making the disk rotor rotated with a wheel by the operation of wheel cylinders 22a and 22b carry out friction engagement of the brake friction pad as a friction engagement member held at rotation impotentia at the mounting bracket which is body flank material. The brake oil pressure corresponding to the treading-in control input (or operating physical force) F of a brake pedal 11 is supplied to each wheel cylinders 22a and 22b from each liquid rooms 23a and 23b of a tandem piston 23. These liquid rooms 23a and 23b are open for free passage to the oil tank 24 in which the brake oil was stored, respectively.

[0021] In addition, although the disk-type hydraulic brakes 21a and 21b were adopted with this operation gestalt, it is also possible to replace these disk-type hydraulic brakes 21a and 21b with a drum-type hydraulic brake, respectively. Also in this case, the drum-type hydraulic brake contains the wheel cylinder, respectively, and gives damping force to the right-and-left front wheels floor line and FR by supply of the brake oil pressure to this wheel cylinder.

[0022] Electro-magnetic valves 25a and 25b are infixed in each ** of each liquid rooms 23a and 23b of a tandem piston 23, and each wheel cylinders 22a and 22b, respectively. Electro-magnetic valves 25a and 25b are maintained at an illustration free passage state at the time of un-energizing, respectively, and are switched to the state of not being open for free passage by energization. The check valves 26a and 26b for returns are connected to these electro-magnetic valves 25a and 25b in parallel, respectively. When electro-magnetic valves 25a and 25b are in the state of not being open for free passage, respectively, check valves 26a and 26b answer treading-in operation release of a brake pedal 11, and cancel the supply brake oil pressure to wheel cylinders 22a and 22b.

[0023] Moreover, electro-magnetic valves 27a and 27b and Reservoirs 28a and 28b are connected to wheel cylinders 22a and 22b at the serial, respectively. Electro-magnetic valves 27a and 27b are maintained at illustration the state of not being open for free passage, at the time of un-energizing, respectively, forbid the spill of the brake oil from wheel cylinders 22a and 22b to Reservoirs 28a and 28b, are switched to a free passage state by energization, and permit defluxion of the aforementioned brake oil. The pumps 32a and 32b driven by the electrical motor 31, respectively are connected to Reservoirs 28a and 28b. Pumps 32a and 32b pump up the brake oil in reservoir 28a and 28b, and supply it to the upstream of electro-magnetic valves 25a and 25b.

[0024] Next, fluid-pressure formula brake gear HB electric control equipment is explained. This electric control equipment is equipped with the hydraulic brake controller 40. The hydraulic brake controller 40 is constituted considering the computer 41 containing CPU, ROM, and RAM as a subject. The computer 41 of the hydraulic brake controller 40 controls the brake oil pressure which controls electro-magnetic valves 25a, 25b, 27a, and 27b and an electrical motor 31 by program execution which was memorized by ROM, and which is mentioned later while detecting fluid-pressure formula brake gear HB abnormalities, and is supplied to wheel cylinders 22a and 22b regardless of operation of this pedal 11, corresponding to operation of a brake pedal 11. The control input sensor 51, the brake-pedal switch 52, oil pressure sensors 53a, 53b, 54a, and 54b, the vehicle speed sensor 55, and the wheel speed sensors 56a and 56b are connected to the input side of the hydraulic brake controller 40.

[0025] The control input sensor 51 detects the treading-in control input (or operating physical force) F of a brake pedal 11. In addition, since this control input F is energized by the criteria position with the spring which a brake pedal 11 does not illustrate, it corresponds to this pedal 11 at *****. In addition, the actual operating physical force F to which this control input sensor 51 is given by the brake pedal 11 may be detected, and you may replace, and may make it detect the aforementioned control input (or operating physical force) F from the oil pressure value in a tandem piston 23.

[0026] The brake-pedal switch 52 is switched according to operation of a brake pedal 11, and it switches off in the state of un-operating [of this pedal 11] it, and switches on in the state of operation. Oil pressure sensors 53a and 53b detect the brake oil pressure (MP1, MP2) of both the liquid rooms 23a and 23b of a tandem piston 23, respectively. Oil pressure sensors 54a and 54b detect the brake oil pressure in wheel-cylinder 22a and 22b, respectively. The vehicle speed sensor 55 detects the vehicle speed V by detecting rotation of the output shaft of a change gear. The wheel speed sensors 56a and 56b are formed in the right-and-left front wheels floor line and FR, respectively, and detect the wheel speed Vw1 and Vw2 of the right-and-left front wheels floor line and FR.

[0027] Electromotive brake gear EB is equipped with the electric brakes 60a and 60b containing electrical motors 61a and 61b, respectively, in order to give damping force at each to the right-and-left rear wheels RL and RR. In this operation form, although electrical motors 61a and 61b are used as the DC motor, they are good also as an ultrasonic motor. Moreover, although the thing of the drum formula later mentioned in detail as electric brakes 60a and 60b was adopted with this operation form, it can replace with the electric brakes 60a and 60b of a drum formula, and the electric brake of a disk formula can also be used.

[0028] Here, the electric brakes 60a and 60b used with this operation form are explained in detail. These electric brakes 60a and 60b are duet servo type things, as shown in drawing 2. The electric brakes 60a and 60b are constituted identically, are prepared in the back up plate 200 which accomplished disc-like mostly, and its back up plate 200, and contain the brake shoes 202a and 202b of the couple which constituted the shape of radii generally, the drum 206 which rotates a friction surface 204 with a wheel in preparation for inner skin, and the electric actuator 207 which makes the end sections of the shoes 202a and 202b of a couple extend. A back up plate 200 is attached in the body flank material which is not illustrated impossible [rotation].

[0029] In the end section which counters mutually, respectively, by being made to engage with the anchor pin 208 fixed to the back up plate 200, the brake shoes 202a and 202b of a couple are held possible [rotation], where rotating with a drum 206 is prevented. Moreover, the other end is connected by the strut 210. The force of acting on one shoe by the strut 210 is transmitted to the shoe of another side. In addition, movement of the brake shoes 202a and 202b of a couple is enabled along the field of that at the back up plate 200 by the shoe holddown equipments 212a and 212b.

[0030] As shown in drawing, the other end of the brake shoes 202a and 202b of a couple is energized by the sense which approaches mutually with a spring 214, and they are energized by the end section toward the anchor pin 208 by each shoe return springs 215a and 215b. Moreover, the strut 216 and the return spring 218 are also formed in the end section.

[0031] In the peripheral face of each brake shoes 202a and 202b, the brake lining 219a and 219b

as a friction engagement member is held, and when the brake lining 219a and 219b of these couples is made to carry out friction engagement by the inner skin 204 of a drum 206, frictional force occurs between brake lining 219a and 219b and a drum 206, respectively. In this operation gestalt, a strut 210 is equipped with an adjustment mechanism and adjusts the crevice between brake lining 219a and 219b and the drum inner skin 204 according to wear of brake lining 219a and 219b.

[0032] As for each brake shoes 202a and 202b, the end section of Levers 230a and 230b is prepared in Webs 222a and 222b possible [rotation] through Pins 232a and 232b including Rims 224a and 224b and Webs 222a and 222b, respectively. The notch is prepared in the portion of Levers 230a and 230b and Webs 222a and 222b which counters mutually, respectively, and it is prepared in the state where the aforementioned strut 216 engaged with these notches, and ends were made to engage with Levers 230a and 230b and Webs 222a and 222b.

[0033] The electric actuator 207 containing electrical-motor 61a (or 61b) is connected with the other end of lever 230a, and the end section of parking brake cable 14a (or 14b) is connected with the other end of lever 230b. When the brake pedal 11 for service brakes is operated, lever 230a is rotated by the drive of electrical-motor 61a or 61b (electric actuator 207), and the brake shoes 202a and 202b of a couple are made to be extended by the strut 216. Moreover, when the parking pedal 12 is operated, lever 230b is rotated and the brake shoes 202a and 202b of a couple are made to be extended by the strut 216. In addition, the return spring 244 is arranged in parking brake cable 14a (or 14b) and the same axle between the other end of lever 230b, and the back up plate 200.

[0034] The electric actuator 207 contains the reducer and movement DBMS other than the above-mentioned electrical-motor 61a (or 61b). Rotation of the output shaft of electrical-motor 61a (or 61b) is decelerated by the reducer, the rotation is changed into rectilinear motion according to a ball-thread mechanism, and the other end of lever 230a is connected with the output member of the ball-thread mechanism.

[0035] as mentioned above, parking brake cable 14a (or 14b) is connected with the parking-brake mechanism 13 in the other end, and responded to the operating physical force (control input) of the parking pedal 12 -- it pulls and the force is given According to this hauling force, lever 230b rotates to the sense which the brake shoes 202a and 202b of a couple extend.

[0036] Next, the electric control equipment of electromotive brake gear EB is explained. This electric control equipment is equipped with the electric brake controller 70. The electric brake controller 70 is also constituted considering the computer 71 containing CPU, ROM, and RAM as a subject. By the program execution which was memorized by ROM and which is mentioned later, the computer 71 of the electric brake controller 70 controls electrical motors 61a and 61b, and carries out braking control of the right-and-left rear wheels RL and RR according to operation of a brake pedal 11 while it detects the abnormalities of electromotive brake gear EB. While this electric brake controller 70 is connected to the hydraulic brake controller 40 and delivering and receiving a signal, the parking-brake switch 81, the braking torque sensors 82a and 82b, the wheel speed sensors 83a and 83b, the motor current sensors 84a and 84b, the rudder angle sensor 85, and the gear change position sensor 86 are connected to the input side. Moreover, the control input sensor 51, the brake-pedal switch 52, and the vehicle speed sensor 55 which were mentioned above are also connected to this electric brake controller 70.

[0037] The parking-brake switch 81 consists of circuit changing switches attached to the parking-brake mechanism, is usually maintained at the OFF state, and if the damping force for parkings is given by treading-in operation of the parking pedal 12, it will be switched to an ON state. It is distorted, it consists of sensors and the braking torque sensors 82a and 82b detect the damping torque which was attached in the anchor pin 208 of the electric brakes 60a and 60b and which is generated by each electric brakes 60a and 60b based on distortion of an anchor pin 208. In addition, when it replaces with the electric brakes 60a and 60b of a drum formula and an electric disk brake is adopted, the braking torque sensors 82a and 82b are constituted by the distortion sensor attached in the mounting bracket.

[0038] The wheel speed sensors 83a and 83b are formed in the right-and-left rear wheels RL and RR, respectively, and detect the wheel speed Vw3 and Vw4 of the right-and-left rear wheels

RL and RR. The motor current sensors 84a and 84b are included in the drive circuit 62, and detect the actual current I which flows in the coil of the electrical motors 61a and 61b of the electric brakes 60a and 60b. The rudder angle sensor 85 is attached to a handle shaft, and detects steering angle θ of the right-and-left front wheels floor line and FR by detecting the angle of rotation of a handle. However, this steering angle θ expresses "0" in the center valve position of the right-and-left front wheels floor line and FR, expresses rightward steering with positive, and expresses leftward steering with negative. The gear change position sensor 86 is attached to a change gear, and detects the position (especially parking position) of a shift lever.

[0039] On the other hand, the aforementioned drive circuit 62 is connected to the output side of the electric brake controller 70. The drive circuit 62 supplies current to electrical motors 61a and 61b from a battery 63 according to the command signal from the electric brake controller 70. In this operation, the command signal showing a duty ratio is outputted to the drive circuit 62 from the electric brake controller 70, and ***** current is supplied to the aforementioned duty ratio at electrical motors 61a and 61b.

[0040] In addition, although detailed explanation is omitted in this specification, you may make it form position sensors 89a and 89b in electric brake 60a and 60b at drawing 1, as a dashed line shows. These position sensors 89a and 89b detect and output the relative position to the drum 206 of brake shoes 202a and 202b by measuring the angle of rotation of electrical motors 61a and 61b. And these position sensors 89a and 89b Electrical motors 61a and 61b are rotated at high speed until brake lining 219a and 219b contacts the inner skin 204 of a drum 206. raise the responsibility of generating of damping torque or It is used for improvement in the control precision of the damping force grant to the right-and-left rear wheels RL and RR, and uses as substitution of this sensor at the time of the abnormalities of the sensor used for damping force grant control of the braking torque sensors 82a and 82b etc.

[0041] Hereafter, operation of the brake gear for vehicles constituted as mentioned above is explained. First, the case where fluid-pressure formula brake gear HB and electromotive brake gear EB are also normal is explained. In fluid-pressure formula brake gear HB, if electro-magnetic valves 25a, 25b, 27a, and 27b are maintained at the illustration state by un-energizing and treading-in operation of the brake pedal 11 is not carried out, brake oil pressure is not supplied to wheel cylinders 22a and 22b, and the damping force by hydraulic brakes 21a and 21b is not given to the right-and-left front wheels floor line and FR. If treading-in operation of the brake pedal 11 is carried out, a tandem piston 23 will supply the brake oil pressure according to the treading-in control input (or operating physical force) F of this pedal 11 to wheel cylinders 22a and 22b. Therefore, hydraulic brakes 21a and 21b give the damping force according to the control input (or operating physical force) F of a brake pedal 11 to the right-and-left front wheels floor line and FR. In addition, in this case, the hydraulic brake controller 40 performs the program which is not illustrated, and is performing detection processing of fluid-pressure formula brake gear HB abnormalities.

[0042] On the other hand, in electromotive brake gear EB, the electric brake controller 70 is repeating and performing the rear wheel braking program of drawing 3 for every predetermined short time. It is started at Step S10 and this program execution judges whether based on the signal from the brake-pedal switch 52, treading-in operation of the brake pedal 11 is carried out at Step S12. If treading-in operation of the brake pedal 11 is not carried out, the command signal which judges with "NO" at Step S12, and expresses current "0" (current OFF) with Step S14 is outputted to the drive circuit 62. Therefore, since the drive circuit 62 does not pass current to electrical motors 61a and 61b in this case, the damping force by the electric brakes 60a and 60b is not given to the right-and-left rear wheels RL and RR.

[0043] If treading-in operation of the brake pedal 11 is carried out, it will be judged with "YES" at the aforementioned step S12, and a program will be advanced to Step S16. In Step S16, based on the signal from the hydraulic brake controller 40, it judges whether fluid-pressure formula brake gear HB is unusual so that it may mention later in detail. Now, since fluid-pressure formula brake gear HB is normal, it judges with "NO" at Step S16, and judges whether the operation suppression conditions of electromotive brake gear EB are satisfied at Step S18. This operation

suppression condition judges whether under the pole low-speed runs at the time of traffic congestion etc. and a parking brake are operating during a halt of vehicles by the criteria of following the (1) - (5).

[0044] (1) the vehicle speed V detected by the vehicle speed sensor 55 expresses the idle state of vehicles -- it is "0" mostly In addition, you may make it calculate the aforementioned vehicle speed V using the wheel speed $Vw1$, $Vw2$, $Vw3$, and $Vw4$ detected by the wheel speed sensors 56a, 56b, 83a, and 83b. Moreover, you may make it the treading-in time of a brake pedal 11 add a ***** to the aforementioned conditions ($V=0$) as AND conditions rather than a predetermined time. In addition, the treading-in time of a brake pedal 11 is detected by measuring with the timer which prepared the time which the brake-pedal switch 52 is continuing turning on in the computer 71.

[0045] (2) It is below V_0 to which the vehicle speed V detected by the vehicle speed sensor 55 expresses the pole low-speed state of vehicles. Moreover, you may make it calculate the aforementioned vehicle speed V also in this case using the wheel speed $Vw1$, $Vw2$, $Vw3$, and $Vw4$ detected by the wheel speed sensors 56a, 56b, 83a, and 83b.

[0046] (3) The control input (or operating physical force) F of the brake pedal 11 detected by the control input sensor 51 should be below the small predetermined value F_0 . Moreover, you may make it add the conditions ($V \leq V_0$) of the above (2) to the aforementioned conditions ($F \leq F_0$) as AND conditions.

[0047] (4) Treading-in operation of the parking pedal 12 is carried out, and the parking-brake switch 81 should be in an ON state.

[0048] (5) The shift lever detected by the gear change position sensor 86 should be in a parking position. Moreover, you may make it add the conditions (for the parking-brake switch 81 to be an ON state) of the above (4) to this condition as AND conditions.

[0049] The above (1) If all conditions of - (5) are not satisfied, it judges with "NO, i.e., operation suppression conditions," not being materialized at the aforementioned step S18, usual control processing of an electric brake is performed at Step S20, and this rear wheel braking program execution is once ended at Step S26.

[0050] In usual control processing of the electric brake of this step S20, the current which flows on the electric motors 61a and 61b so that real damping torque T which target damping torque T^* corresponding to the control input (or operating physical force) F of the brake pedal 11 detected by the control input sensor 51 was calculated, and was detected by the braking torque sensors 82a and 82b by said-calculated target damping torque T^* may be in agreement, respectively is controlled. In this case, the command signal showing the duty ratio for passing the aforementioned current to electrical motors 61a and 61b is supplied to the drive circuit 62, and the drive circuit 62 passes the aforementioned current from a battery 63 to electrical motors 61a and 61b by the aforementioned command signal.

[0051] Electrical motors 61a and 61b rotate lever 230a with the driving force according to the aforementioned supply current. The shoes 202a and 202b of a couple are made to be extended by the strut 216, and a friction engagement member (brake lining 219a and 219b) is forced on the inner skin 204 of a drum 206. A friction engagement member is made to carry out friction engagement by the drum inner skin 204, and is generated by frictional force among these. Therefore, rotation of a wheel is suppressed and damping torque is given to a wheel.

[0052] It takes and the surroundings force and the driving force by the electric actuator 207 based on the frictional force produced in one shoe 202b are transmitted to the other end of shoe 202a of another side through a strut 210 from the other end. shoe 202a of another side -- this -- it takes, and is pushed against the drum inner skin 204 by the sum of the surroundings force and the extension force, and bigger frictional force than one shoe 202b arises. Consequently, damping torque equal to target damping torque T^* corresponding to the control input (or operating physical force) F of a brake pedal 11 is given to the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b. Thus, since the output of one shoe 202b turns into an input of shoe 202a of another side and the double servo effect is moreover acquired, big damping torque can be obtained in a duet servo type drum brake.

[0053] Grant control of the damping torque to the right-and-left rear wheels RL and RR by this

electric brake controller 70 is explained in detail using the functional block diagram of drawing 4. In block B1, target damping torque T^* is determined based on the control input (or operating physical force) F of the brake pedal 11 by the operator. block B-2 and B3 -- setting -- the relation between target damping torque T^* and target current-value I^* -- therefore, target current-value I^* is determined -- having -- the relation between target current-value I^* and a duty ratio -- therefore, a duty ratio is called for and the command signal showing it is outputted to the drive circuit 62. On the other hand, if damping torque is given to the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b, this damping torque will be detected by the braking torque sensors 82a and 82b, and said-detected real damping torque T will be fed back. And the control signal corresponding to the deflection of target damping torque T^* and real damping torque T is added to the signal showing the aforementioned duty ratio, and the command signal showing this addition result comes to be outputted to the drive circuit 62. [0054] Consequently, feedback control of the current which flows to electrical motors 61a and 61b will be carried out, and the electric brakes 60a and 60b will brake the right-and-left rear wheels RL and RR with damping torque equal to target damping torque T^* so that the deflection of target damping torque T^* and real damping torque T may be lost. In addition, even if it makes it determined based on an actual difference and makes it determined based on the differential value of a difference, you may make it determined based on an integration value, and may make it determined in the feedback control of this damping torque or more based on two, an actual difference, a differential value, and an integration value. Moreover, the table which expresses the relation between above-mentioned target damping torque T^* and target current-value I^* (when coefficient of friction is set to basic value μ_0), Although the table showing the relation between target current-value I^* and a duty ratio and the table showing the relation between the brakes operation force F and target damping torque T^* are stored in ROM prepared in the computer 71 and each value is determined using each table. Each value can be calculated according to an operation.

[0055] Moreover, in usual control processing of the electric brake of Step S20, it is also possible to replace with the aforementioned torque feedback control, and to feed back and control the current I which flows to electrical motors 61a and 61b. If this current feedback control is explained using a control function block diagram like the above, drawing 5 shows this control function block diagram. First, as shown in block B11, target brake actuation load D^* is determined based on the brakes operation force F . In addition, this brake actuation load is the force brought to the electric brakes 60a and 60b by electrical motors 61a and 61b and force specifically brought to lever 230a by electrical motors 61a and 61b. Next, as shown in blocks B12 and B13, target current-value I^* is determined based on the relation between target brake actuation load D^* and target current-value I^* , and a duty ratio is determined based on the relation between target current-value I^* and a duty ratio. And the real motor current I detected by the motor current sensors 84a and 84b in this case is fed back, and the amount of feedback control according to target current-value I^* and difference $I^* - I$ of the real motor current value I which made [aforementioned] a decision is added to the duty ratio by which a decision was made [aforementioned], and is outputted to the drive circuit 62 as a command signal.

[0056] Thereby, the drive circuit 62 is controlled by the aforementioned command signal, and passes current equal to electrical motors 61a and 61b to target current-value I^* from a battery 63. Therefore, the electric brakes 60a and 60b generate target brake actuation load D^* corresponding to the control input (or operating physical force) F of a brake pedal 11. In addition, the table showing the relation between above-mentioned target brake actuation load D^* and target current-value I^* , the table showing the relation between target current-value I^* and a duty ratio, the table showing the relation between the amount F of brakes operation (or operating physical force) and target brake actuation load D^* , etc. are beforehand memorized by ROM. Although it is also possible to control the electric brakes 60a and 60b also by such control, if this control is compared with the torque feedback control mentioned above, although the more nearly aforementioned control is not necessarily exact, it is suitable for using, when the detection precision of real damping torque T under halt of vehicles etc. is not good in that real damping torque T is not used.

[0057] In addition, in the aforementioned current control, although the current I which is actually flowing to electrical motors 61a and 61b was fed back, as long as it can feed back this current I and can make the electric brakes 60a and 60b generate a desired actuation load that there is nothing, you may omit this current feedback. In this case, what is necessary is to omit the path which feeds back the current I of the electrical motors 61a and 61b of drawing 5, and just to supply the command signal showing the duty ratio determined with block B13 to the direct drive circuit 62.

[0058] On the other hand, if either of the conditions of aforementioned (1) – (5) is materialized, it will judge with “YES, i.e., operation suppression conditions,” being materialized at the aforementioned step S18, electric brake prohibition (suppression) processing will be performed at Step S22, and this rear wheel braking program execution will once be ended at Step S26.

[0059] The current which flows to electrical motors 61a and 61b is made for current not to flow to OFF 61a and 61b, i.e., electrical motors, in Step S22. Therefore, in this case, the electric brakes 60a and 60b do not brake the right-and-left rear wheels RL and RR with the driving force of electrical motors 61a and 61b. However, in the state where treading-in operation of the parking pedal 12 is carried out, pull to the parking brake cables 14a and 14b, and the force is given, since these cables 14a and 14b rotate lever 230b to the sense which the brake shoes 202a and 202b of a couple extend, the damping force by treading-in operation of the parking pedal 12 is given to the right-and-left rear wheels RL and RR. Moreover, also in this state, while the damping force by hydraulic brakes 21a and 21b is given to the right-and-left front wheels floor line and FR, during the operation of a parking brake, the damping force of the electric brakes 60a and 60b by operation of the parking pedal 12 is also given to the right-and-left rear wheels RL and RR.

[0060] Thus, during a halt of the vehicles for which grant of prolonged damping force may be needed, although big damping force is unnecessary, since it was made for current not to flow to electrical motors 61a and 61b when under the pole low-speed runs at the time of traffic congestion etc. or a parking brake was operating, generation of heat of the electrical motors 61a and 61b by continuation energization, breakage of a coil, consumption of useless power, etc. can be prevented.

[0061] Moreover, although it was made not to pass current at all to electrical motors 61a and 61b, you may make it pass current [at least] smaller than the current value by usual control processing of the electric brake of the aforementioned step S20 in electric brake prohibition (suppression) processing of the aforementioned step S22. In this case, what is necessary is just to pass the small predetermined current defined beforehand to electrical motors 61a and 61b. Moreover, it sets in the state where the brake pedal 11 is operated. Only the specified quantity beforehand defined rather than target damping torque F^* determined at the aforementioned step S20 calculates small target damping torque or the target damping torque which multiplied by the predetermined ratio smaller than “1” beforehand set to this target damping torque F^* . The current which flows on the electric motors 61a and 61b is controlled to become the said-calculated target damping torque, and you may make it restrict the current which flows on these motors 61a and 61b. Moreover, what is necessary is just to restrict the current which flows to electrical motors 61a and 61b to small current value, as target current-value I^* is set up by the same technique as the case of aforementioned target damping torque F^* smaller than the case of this step S20, in controlling to pass target current I^* to electrical motors 61a and 61b at the aforementioned step S20 (in the case of drawing 5).

[0062] Consequently, also by this, during a halt of vehicles, when under the pole low-speed runs at the time of traffic congestion etc. or a parking brake is operating, generation of heat of the electrical motors 61a and 61b by continuation energization, breakage of a coil, consumption of useless power, etc. can be prevented. It is effective to suppress small the current which flows on these motors 61a and 61b to make it not pass current to electrical motors 61a and 61b especially at the time of formation of condition $V \leq V_o$ of (2) in aforementioned condition (1) – (5) or condition $F \leq F_o$ of (3), and to restrict small the damping force by the electric brakes 60a and 60b.

[0063] Next, the case where abnormalities occur is explained to fluid-pressure formula brake

gear HB or electromotive brake gear EB. By the program execution which is not illustrated, the computer 41 of the hydraulic brake controller 40 inputs the brake oil pressure in wheel-cylinder 22a and 22b from the brake oil pressure and the oil pressure sensors 54a and 54b in each liquid room 23a of oil pressure sensors 53a and 53b to the tandem piston 23, and 23b, and judges abnormalities fluid-pressure formula brake gear HB [, such as an oil pressure fault,] according to each brake oil pressure.

[0064] In the judgment of this abnormality, while inputting the control input (control force) F of a brake pedal 11 from the control input sensor 51, the signal with which the existence of operation of a brake pedal 11 is expressed from the brake-pedal switch 52 is inputted, and the brake oil pressure which carried out [aforementioned] the input judges by whether the value corresponding to operation of a brake pedal 11 is shown. For example, although the brake-pedal switch 52 expresses operation of a brake pedal 11, if it judges with abnormalities having occurred in brake-system ** of the forward left ring floor line if the brake oil pressure from oil pressure sensors 53a and 54a shows atmospheric pressure and the brake oil pressure from oil pressure sensors 53b and 54b shows atmospheric pressure, it will judge with abnormalities having occurred in brake-system ** of the forward right ring FR. Moreover, if the brake oil pressure from oil pressure sensors 53a and 54a is small compared with the oil pressure which is equal to a control input (or operating physical force) F from the control input sensor 51 It judges with abnormalities having occurred in brake-system ** of the forward left ring floor line, and if the brake oil pressure from oil pressure sensors 53b and 54b is small compared with the oil pressure which is equal to a control input (or operating physical force) F from the control input sensor 51, it will judge with abnormalities having occurred in brake-system ** of the forward right ring FR. And at the time of such malfunction detection, the signal which expresses the aforementioned abnormalities with the computer 71 of the electric brake controller 70 from the computer 41 of the hydraulic brake controller 40 is outputted.

[0065] Among the rear wheel braking program execution of aforementioned drawing 3 , by Step S16, the computer 71 of the electric brake controller 70 judges with abnormalities having occurred in "YES, i.e., a hydraulic brake system," , performs the fluid-pressure system unusual routine of Step S24, and once ends this rear wheel braking program execution at Step S26.

[0066] This fluid-pressure system unusual routine is shown in drawing 6 in detail, and the execution is started at Step S30, and it calculates target damping torque T^* at Step S32. The calculation method of this target damping torque T^* is determined corresponding to a control input (or operating physical force) F like the case of usual control processing of the electric brake of the aforementioned step S20 (block B1 reference of drawing 4). Next, it judges whether vehicles are in a rectilinear-propagation state by inputting steering angle θ_{taf} detected by the rudder angle sensor 85 at Step S34, and judging whether absolute value $|\theta_{taf}|$ of this steering angle θ_{taf} is θ_{taf0} or less small predetermined value.

[0067] By vehicles being in a rectilinear-propagation state mostly, if absolute value $|\theta_{taf}|$ of steering angle θ_{taf} is θ_{taf0} or less small predetermined value It judges with "YES" at Step S34, the positive predetermined value α is added to target damping torque T^* which carried out [aforementioned] calculation at Step S36, and each target damping torque tangent line* ($=T^*+\alpha$) of the right-and-left rear wheels RL and RR and TR^* ($=T^*+\alpha$) are calculated, respectively. And like the case of usual control processing of the electric brake of the aforementioned step S20, the current which flows to electrical motors 61a and 61b is controlled by Step S48 so that the damping torque given to the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b becomes equal to aforementioned target damping torque tangent line* and TR^* (block B-2 of drawing 4 , B3 reference). Thereby, compared with the case of usual control processing of the electric brake of the aforementioned step S20, damping torque only with the big predetermined value α is given to the right-and-left rear wheels RL and RR, respectively.

[0068] On the other hand, by vehicles being in a revolution state, if absolute value $|\theta_{taf}|$ of steering angle θ_{taf} is larger than the aforementioned predetermined value θ_{taf0} , it will judge with "NO" at Step S34, and a program will be advanced to Steps S38 and S40. In Steps S38 and S40, it judges whether abnormalities have occurred in which brake-system ** of the right-and-

left front wheels floor line and FR based on the signal showing the abnormalities from the computer 41 of the aforementioned hydraulic brake controller 40.

[0069] If abnormalities have occurred only in brake-system ** of the forward left ring floor line, it will judge with "YES" at Step S38. While calculating target damping torque tangent line* ($=T^{*}+\alpha$) of the left rear ring RL by adding the positive predetermined value α to target damping torque T^{*} which carried out [aforementioned] calculation at Step S42 Target damping torque TR^{*} ($=T^{*}-\beta$) of the right rear ring RR is calculated by subtracting the positive predetermined value β from this target damping torque T^{*} . And like the above, the current which flows to electrical motors 61a and 61b is controlled by Step S48 so that the damping torque given to the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b becomes equal to aforementioned target damping torque tangent line* and TR^{*} . Thereby, while damping torque only with the big predetermined value α is given compared with the case of usual control processing of the electric brake of the aforementioned step S20, compared with the case of usual control processing of the electric brake of the aforementioned step S20, damping torque only with the small predetermined value β is given to the right rear ring RR at the left rear ring RL.

[0070] Moreover, if vehicles are in a revolution state and abnormalities have occurred only in brake-system ** of the forward right ring FR While calculating target damping torque tangent line* ($=T^{*}-\beta$) of the left rear ring RL by judging with "YES" at Step S40, and subtracting the positive predetermined value β from aforementioned target damping torque T^{*} at Step S44 Target damping torque TR^{*} ($=T^{*}+\alpha$) of the right rear ring RR is calculated by adding the positive predetermined value α to this target damping torque T^{*} . And like the above, the current which flows to electrical motors 61a and 61b is controlled by Step S48 so that the damping torque given to the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b becomes equal to aforementioned target damping torque tangent line* and TR^{*} . Thereby, contrary to the above, while damping torque only with the small predetermined value β is given compared with the case of usual control processing of the electric brake of the aforementioned step S20, compared with the case of usual control processing of the electric brake of the aforementioned step S20, damping torque only with the big predetermined value α is given to the right rear ring RR at the left rear ring RL.

[0071] Furthermore, if vehicles are in a revolution state and abnormalities have occurred in both brake-systems ** of the right forward right rings floor line and FR, it will judge with "NO" at both the steps S38 and S40, and will be set as target damping torque T^{*} which calculated each target damping torque tangent line* of the right-and-left rear wheels RL and RR, and TR^{*} by processing of the aforementioned step S32 at Step S46, respectively. And it is controlled by processing of Step S48 so that the damping torque given to the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b becomes the same target damping torque tangent line* as the case of usual control processing of the electric brake of the aforementioned step S20, and TR^{*} .

[0072] Drawing 7 shows the braking force control of the right-and-left rear wheels RL and RR by the aforementioned fluid-pressure system unusual routine collectively. In addition, among drawing 7, O mark expresses normal brake-system **, and expresses brake-system ** with unusual x mark. Moreover, a upward arrow expresses the increase in damping force, a downward arrow expresses reduction in damping force, and the sideways arrow expresses the increase and decrease of a **** of damping force. When abnormalities occur to a part of fluid-pressure formula brake gear HB in the state where vehicles are in a rectilinear-propagation state mostly so that he can understand from now on, both the damping force of the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b is greatly controlled compared with the case where both brake-system ** of both right-and-left front wheels floor line and FR are normal. Shortage of damping force fluid-pressure formula brake gear HB [for the right-and-left front wheels floor line and FR] is compensated by electromotive brake gear EB for the right-and-left rear wheels RL and RR, and vehicles are braked by change of the braking-force-distribution ratio of the right-and-left rear wheels RL and RR to such right-and-left front wheels floor line and FR good.

[0073] moreover, during revolution of vehicles, when abnormalities occur in one brake-system ** of the right-and-left front wheels floor line and FR the front wheel which abnormalities generated, and right and left -- the damping force by electric brake 60a (or electric brake 60b) to the left rear ring RL (or right rear ring RR) in the same side is greatly controlled compared with the case where both brake-system ** of both right-and-left front wheels floor line and FR are normal. The damping force by electric brake 60b (or electric brake 60a) to the wheel which could come, simultaneously abnormalities generated, and the right rear ring RR (or left rear ring RL) in a diagonal position is small controlled compared with the case where both brake-system ** of both right-and-left front wheels floor line and FR are normal. Generating of the angular moment of the circumference of the normal axis which originates in the damping force grant to a wheel, and works into the body by change of such a braking force distribution of the right-and-left rear wheels RL and RR is suppressed, and run stability can be secured. Moreover, depending on how to give the predetermined values alpha and beta, increase control of the damping force to the right-and-left rear wheels RL and RR is carried out, shortage of damping force fluid-pressure formula brake gear HB [for the right-and-left front wheels floor line and FR] is compensated by electromotive brake gear EB for the right-and-left rear wheels RL and RR, and vehicles are braked good. In addition, it is for avoiding the spin of vehicles not to make the damping force of the right-and-left rear wheels RL and RR increase during revolution of vehicles, when abnormalities occur in brake-system ** of both right-and-left front wheels floor line and FR.

[0074] Next, the modification which transformed the fluid-pressure system unusual routine of aforementioned drawing 6 like drawing 8 is explained. Also in this case, target damping torque T^* is calculated like the case of aforementioned drawing 6 at Step S62 after the execution start of Step S60. However, in this case, it is once set as each target damping torque tangent line* of the right-and-left rear wheels RL and RR, and target damping torque T^* which carried out [aforementioned] calculation of TR^* . Next, in Steps S64 and S66, it judges whether abnormalities have occurred in which brake-system ** of the right-and-left front wheels floor line and FR based on the signal showing the abnormalities from the computer 41 of the aforementioned hydraulic brake controller 40.

[0075] If abnormalities have occurred only in brake-system ** of the forward left ring floor line, it will judge with "YES" at Step S64. It judges whether the present rolling-stock-run state decided by the aforementioned vehicle speed V and steering angle θ_{taf} is in the damping force grant keepout area of the right rear ring RR by inputting the vehicle speed V and steering angle θ_{taf} from the vehicle speed sensor 55 and the rudder angle sensor 85 at Step S68, and referring to the table A memorized by ROM. As shown in drawing 9 (A), this table A was decided by the vehicle speed V and steering angle θ_{taf} , and has memorized the data which specify the field which gives damping force to the right rear ring RR at the time of the abnormalities of brake-system ** of the forward left ring floor line, and the field (hatching field of drawing 9 (A)) which forbids grant of this damping force. In this case, if under a positive small predetermined value, i.e., vehicles, has steering angle θ_{taf} in rectilinear propagation or an anticlockwise rotation state mostly, the vehicle speed V will be made into a keepout area more than at the predetermined vehicle speed, at i.e., the time of the high-speed run state of vehicles, and even if the vehicle speed V becomes small as steering angle θ_{taf} will become large, if beyond the aforementioned predetermined value, i.e., vehicles, has steering angle θ_{taf} in a clockwise rotation state, it considers as a keepout area.

[0076] And if judged with "YES, i.e., a rolling-stock-run state," being in a keepout area at the aforementioned step S68, target damping torque TR^* of the right rear ring RR will be changed into "0" at Step S70. Moreover, if judged with there being "no NO, i.e., a rolling-stock-run state," in a keepout area at the aforementioned step S68, a program will be advanced to Step S72, maintaining target damping torque TR^* of the right rear ring RR at the value set up at the aforementioned step S62.

[0077] In Step S72, it judges whether the present rolling-stock-run state decided by the aforementioned vehicle speed V and steering angle θ_{taf} is in the increase permitted region in damping force of the left rear ring RL by referring to the table C memorized by ROM. This table

C is decided by the vehicle speed V and steering angle θ_{taf} as shown in drawing 9 (C). the front wheel which abnormalities have generated at the time of the abnormalities of brake-system ** of the forward left ring floor line or the forward right ring FR, and right and left -- the rear wheel of the same side -- the time of the abnormalities of both (however the right-and-left front wheels floor line and FR -- both right-and-left rear wheels RL and RR -- the data which specify the field (hatching field of drawing 9 (C)) which permits increasing the damping force given to), and the field which forbids the increase in this damping force are memorized In this case, even if the vehicle speed becomes small as absolute value $|\theta_{\text{taf}}|$ of steering angle θ_{taf} is large, namely, the TR of vehicles becomes small, the increase in damping force is forbidden. Even if the vehicle speed V becomes large as in other words the TR of vehicles becomes large and a rectilinear-propagation run is approached, the increase in damping force is permitted.

[0078] And if judged with "YES, i.e., a rolling-stock-run state," being in an increase permitted region at the aforementioned step S72, target damping torque tangent line* of the left rear ring RL will be changed into value tangent line*+alpha only with the positive bigger predetermined value alpha than this torque tangent line* at Step S74. Moreover, if judged with there being "no NO, i.e., a rolling-stock-run state," in an increase permitted region at the aforementioned step S72, a program will be advanced to Step S88, maintaining target damping torque tangent line* of the left rear ring RL at the value set up at the aforementioned step S62. In Step S88, it is controlled so that each damping torque given to the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b becomes equal to target damping torque tangent line* which carried out [aforementioned] a setup, and TR* like the case of Step S48 of aforementioned drawing 6 .

[0079] On the other hand, if abnormalities have occurred only in brake-system ** of the forward right ring FR, it will judge with "YES" at Step S66. It judges whether the present rolling-stock-run state decided by the aforementioned vehicle speed V and steering angle θ_{taf} is in the damping force grant keepout area of the left rear ring RL by inputting the vehicle speed V and steering angle θ_{taf} from the vehicle speed sensor 55 and the rudder angle sensor 85 at Step S76, and referring to the table B memorized by ROM. As shown in drawing 9 (B), this table B was decided by the vehicle speed V and steering angle θ_{taf} , and has memorized the data which specify the field which gives damping force to the left rear ring RL at the time of the abnormalities of brake-system ** of the forward right ring FR, and the field (hatching field of drawing 9 (B)) which forbids grant of this damping force. In this case, if steering angle θ_{taf} is larger than a negative predetermined value with a small absolute value, i.e., vehicles are in rectilinear propagation or a clockwise rotation state mostly Even if the vehicle speed V becomes small as steering angle θ_{taf} will become small (absolute value $|\theta_{\text{taf}}|$ of steering angle θ_{taf} is greatly), if the vehicle speed V is made into a keepout area more than at the predetermined vehicle speed, at i.e., the time of the high-speed run state of vehicles, and below the aforementioned predetermined value, i.e., vehicles, has steering angle θ_{taf} in an anticlockwise rotation state, it considers as a keepout area.

[0080] And if judged with "YES, i.e., a rolling-stock-run state," being in a keepout area at the aforementioned step S76, target damping torque tangent line* of the left rear ring RL will be changed into "0" at Step S78. Moreover, if judged with there being "no NO, i.e., a rolling-stock-run state," in a keepout area at the aforementioned step S76, a program will be advanced to Step S80, maintaining target damping torque tangent line* of the left rear ring RL at the value set up at the aforementioned step S62.

[0081] In Step S80, it judges whether the present rolling-stock-run state decided by the aforementioned vehicle speed V and steering angle θ_{taf} is in the increase permitted region in damping force of the left rear ring RL by referring to the aforementioned table C memorized by ROM. And if judged with "YES, i.e., a rolling-stock-run state," being in an increase permitted region at the aforementioned step S80, target damping torque TR* of the right rear ring RR will be changed into value TR*+alpha only with the positive bigger predetermined value alpha than this torque TR* at Step S82. Moreover, if judged with there being "no NO, i.e., a rolling-stock-run state," in an increase permitted region at the aforementioned step S80, a program will be advanced to the aforementioned step S88, maintaining target damping torque TR* of the right

rear ring RR at the value set up at the aforementioned step S62. And it is controlled by processing of Step S88 so that each damping torque given to the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b becomes equal to target damping torque tangent line* which carried out [aforementioned] a setup, and TR*.

[0082] Moreover, if abnormalities have occurred in both brake-systems ** of the forward left ring floor line and the forward right ring FR By judging with "NO" at both the steps S64 and S66, inputting the vehicle speed V and steering angle θ_{taf} from the vehicle speed sensor 55 and the rudder angle sensor 85 at Step S84, and referring to the table C which was prepared in ROM and which was mentioned above It judges whether the present rolling-stock-run state decided by the aforementioned vehicle speed V and steering angle θ_{taf} is in the increase permitted region in damping force of the right-and-left rear wheels RL and RR. And if judged with "YES, i.e., a rolling-stock-run state," being in an increase permitted region at the aforementioned step S84, target damping torque tangent line* of the right-and-left rear wheels RL and RR and TR* will be changed into value tangent line*+gamma only with the positive, respectively bigger predetermined value gamma than this torque tangent line* and TR*, and TR*+gamma at Step S86. Moreover, if judged with there being "no NO, i.e., a rolling-stock-run state," in an increase permitted region at the aforementioned step S84, a program will be advanced to the aforementioned step S88, maintaining target damping torque tangent line* of the right-and-left rear wheels RL and RR, and TR* at the value set up at the aforementioned step S62. And it is controlled by processing of Step S88 so that each damping torque given to the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b becomes equal to target damping torque tangent line* which carried out [aforementioned] a setup, and TR*.

[0083] According to this modification, the vehicle speed V is not so large. absolute value $|\theta_{taf}|$ of steering angle θ_{taf} therefore, in the state which is not not much large When abnormalities occur in brake-system ** of one side of the right-and-left front wheels floor line and FR, or both the front wheel which abnormalities have generated, and right and left -- the damping force of the rear wheel (both right-and-left rear wheels RL and RR when [However] both right-and-left front wheels floor line and FR are unusual) of the same side is greatly controlled compared with the case where both brake-system ** of both right-and-left front wheels floor line and FR are normal Shortage of the damping force by the fluid-pressure formula brake gear HB for the right-and-left front wheels floor line and FR is compensated by electromotive brake gear EB for the right-and-left rear wheels RL and RR, and vehicles are braked by change of the braking-force-distribution ratio of the right-and-left rear wheels RL and RR to such right-and-left front wheels floor line and FR good. Moreover, the vehicle speed V is large, or since the increase in the damping force of the aforementioned right-and-left rear wheels RL and RR is forbidden when abnormalities occur [absolute value $|\theta_{taf}|$ of steering angle θ_{taf}] in the big state in brake-system ** of one side of the right-and-left front wheels floor line and FR, or both, the lock of the wheel accompanying the increase in damping force is prevented beforehand, and rolling-stock-run stability is secured.

[0084] Moreover, the vehicle speed V is large to some extent, and when abnormalities occur [absolute value $|\theta_{taf}|$ of steering angle θ_{taf}] in the large state in one brake-system ** of the right-and-left front wheels floor line and FR, grant of the damping force to the right-and-left rear wheels RL and RR of a side and a right-and-left opposite side which abnormalities generated is forbidden. Generating of the angular moment of the circumference of the normal axis which works into the body resulting from the damping force grant to a wheel by change of such a braking force distribution of the right-and-left rear wheels RL and RR is suppressed, and run stability can be secured.

[0085] In addition, although it was made to set damping force of the front wheel which abnormalities generated, and the rear wheel of a right-and-left opposite side by processing of Steps S70 and S78 to "0", you may make it suppress generating of the angular moment of the vehicles by damping force in this modification by replacing with this and suppressing to a value smaller than target damping torque tangent line* which set up the damping torque of the aforementioned rear wheel at the aforementioned step S62, and TR*. Furthermore, you may make it set target damping torque tangent line* and TR* as a small (for "0" to be approached)

value also in suppression of the damping force to this rear wheel as the vehicle speed V becomes large, and/or as absolute value $|\theta_{\text{f}}|$ of steering angle θ_{f} becomes large.

[0086] Next, the case where abnormalities occur is explained to electromotive brake gear EB for the right-and-left rear wheels RL and RR. The computer 71 of the electric brake controller 70 is repeating and executing the electric system unusual program of drawing 10 memorized by ROM in parallel to the rear wheel braking program of aforementioned drawing 3.

[0087] It is started at Step S100 and this electric system unusual program judges the abnormalities of a computer 71 and the control input sensor 51 at Step S102. The abnormalities of this computer 71 mean the overrun of the computer 71 detected by the watchdog timer which is not illustrated etc. Moreover, the abnormalities of the control input sensor 51 detect an open circuit of the circumference of this sensor 51, a short circuit, etc. If abnormalities have occurred in the computer 71 and the control input sensor 51 and it is judged with "YES" at the aforementioned step S102, a program will be advanced to Step S104 and this electric system unusual program execution will once be ended at Step S116 after processing of this step S104.

[0088] In Step S104, an operation halt of the electric brakes 60a and 60b is controlled. An operation halt of these electric brakes 60a and 60b means a rear wheel braking program execution halt of drawing 3 mentioned above. Thereby, even if treading-in operation of the brake pedal 11 is carried out, the damping force by the electric brakes 60a and 60b is no longer given to the right-and-left rear wheels RL and RR. Consequently, the grant of damping force which made the mistake in receiving the right-and-left rear wheels RL and RR is avoided, and rolling-stock-run stability is secured.

[0089] On the other hand, if abnormalities have not occurred in a computer 71 and the control input sensor 51, it is judged with "NO" at the aforementioned step S102, and a program is advanced to Step S106. In Step S106, unusual generating of an open circuit of the circumference of braking torque-sensor 82a and 82b, a short circuit, etc. is judged. If abnormalities have not occurred in the braking torque sensors 82a and 82b, it judges with "NO" at Step S106, and a program is advanced to Step S112. In Step S112, abnormalities, such as an open circuit of the circumference of wheel speed sensor 83a and 83b and a short circuit, are judged. If abnormalities have not occurred in the wheel speed sensors 83a and 83b, it judges with "NO" at Step S112, and this electric system unusual program execution is ended at Step S116. In this state, it performs, as the rear wheel braking program of aforementioned drawing 3 mentioned above, and according to treading-in operation of a brake pedal 11, the damping force by the electric brakes 60a and 60b is given to the right-and-left rear wheels RL and RR in the above-mentioned mode.

[0090] On the other hand, when abnormalities have occurred in the braking torque sensors 82a and 82b, processing of Steps S108 and S110 is performed on the basis of the judgment with "YES" in Step S106. Processing of Step S108 directs a switch of the control mode of the electrical motors 61a and 61b by the rear wheel braking program of drawing 3. In the state where abnormalities have occurred, usual control processing of the electric brake of Step S20 of drawing 3 and torque feedback control (control of the functional block diagram of drawing 4) using detection real damping torque T in the fluid-pressure system unusual routine of Step S24 cannot be performed to the braking torque sensors 82a and 82b. Therefore, it is necessary to perform control which does not use real damping torque T , such as current feedback control mentioned above in this case, or current open loop control (control of the functional block diagram of drawing 5). As mentioned above, if a switch of the control mode of electrical motors 61a and 61b is directed by processing of Step S108, drive control of the electrical motors 61a and 61b will be carried out by current feedback control or current open loop control at the time of execution of usual control processing of the electric brake of Step S20 of aforementioned drawing 3, and the fluid-pressure system unusual routine of Step S24. Consequently, even if abnormalities occur in the braking torque sensors 82a and 82b, grant of the damping force to the right-and-left rear wheels RL and RR by treading-in operation of a brake pedal 11 is secured.

[0091] Moreover, processing of Step S110 directs the fall of the gain of control of the electrical motors 61a and 61b by the rear wheel braking program of drawing 3. Thereby, the current control gain of the electrical motors 61a and 61b in current feedback control or current open

loop control falls, namely, target current-value I^* to the control input (or operating physical force) F of the brake pedal 11 in the functional block diagram of drawing 5 is set up low. Therefore, the rate of a braking force distribution of the as opposed to [in other words] right-and-left front wheels floor line and FR right-and-left rear wheels RL and RR by which the damping force to the right-and-left rear wheels RL and RR given by treading-in operation of a brake pedal 11 is stopped low will be kept low. Although the damping torque of the right-and-left rear wheels RL and RR may not be controlled with a sufficient precision by the state where abnormalities have occurred in the braking torque sensors 82a and 82b, by the aforementioned gain control, the lock of the right-and-left rear wheels RL and RR is avoided beforehand, and rolling-stock-run stability is secured.

[0092] Moreover, when abnormalities have occurred in the wheel speed sensors 83a and 83b, processing of Step S114 is performed on the basis of the judgment with "YES" in Step S112. Processing of Step S114 directs the fall of the gain of control of the electrical motors 61a and 61b by the rear wheel braking program of drawing 3. The current control gain of the electrical motors 61a and 61b in the torque feedback control (there is also a case of current feedback control or current open loop control) performed at Steps S20 and S24 of drawing 3 falls by this. That is, target damping torque T^* (or target current-value I^* to the control input (or operating physical force) F of the brake pedal 11 in the functional block diagram of drawing 5) to the control input (or operating physical force) F of the brake pedal 11 in the functional block diagram of drawing 4 (or drawing 6) is set up low. Therefore, the damping force to the right-and-left rear wheels RL and RR given by treading-in operation of a brake pedal 11 also in this case will be stopped low.

[0093] Also in this electromotive brake gear EB, anti-lock brake control (ABS control) is performed by the program execution which is not illustrated, and the lock of the right-and-left rear wheels RL and RR is avoided. However, when abnormalities occur in the wheel speed sensors 83a and 83b, the lock of the right-and-left rear wheels RL and RR must have been detected. By processing of the aforementioned step S114 therefore, by lowering the control gain of electrical motors 61a and 61b The braking force distribution of the right-and-left rear wheels [as opposed to / in other words / the right-and-left front wheels floor line and FR] RL and RR by which big damping force is not given to the right-and-left rear wheels RL and RR is kept low, the lock of the right-and-left rear wheels RL and RR is avoided beforehand, and rolling-stock-run stability is secured.

[0094] Thus, at the time of the abnormalities of electromotive brake gear EB, damping force is not given to the right-and-left rear wheels RL and RR, or the damping force to these rear wheels RL and RR is stopped low at it. On the other hand, in the right-and-left front wheels floor line and FR, the braking force distribution to the aforementioned right-and-left rear wheels RL and RR increases, and vehicles are braked by the damping force to each ring which followed the aforementioned braking force distribution according to treading-in operation of a brake pedal 11. In addition, also in the fluid-pressure formula brake gear HB for the right-and-left front wheels floor line and FR, the lock of the right-and-left front wheels floor line and FR is avoided by anti-lock brake control (ABS control) by the computer 41 of the hydraulic brake controller 40 which is not illustrated. This anti-lock brake control is performed by controlling electro-magnetic valves 25a, 25b, 27a, and 27b and an electrical motor 31 at the time of the lock detection of the right-and-left front wheels floor line and FR based on the wheel speed $Vw1$ and $Vw2$ from the wheel speed sensors 56a and 56b.

[0095] Moreover, although explanation of the electric system unusual routine of aforementioned drawing 10 did not describe, when abnormalities occur in a part or all of electromotive brake gear EB, the information showing these abnormalities is supplied to the computer 41 of the hydraulic brake controller 40 from the computer 71 of the electric brake controller 70. This is answered, and the hydraulic brake controller 40 changes the mode of the damping force grant to the right-and-left front wheels floor line and FR, and you may make it cope with it with fluid-pressure formula brake gear HB.

[0096] For example, although not explained above When abnormalities occur only in any one of the electrical motors 61a and 61b and damping force is given only to one side of the right-and-

left rear wheels RL and RR, reduce one damping force of the right-and-left front wheels floor line and FR, or grant of this damping force is stopped. It is good to make it the angular moment by damping force not act on vehicles, as vehicles are mainly braked by the rear wheel by the side of normal and the front wheel in a diagonal position. By in this case, the method explained by drawing 6 and the fluid-pressure system unusual routine of 8 and a method of the same kind Based on the information, the vehicle speed V , and steering angle θ which show the rear wheel which abnormalities have generated, by controlling electro-magnetic valves 25a, 25b, 27a, and 27b What is necessary is making it just stop or decrease the brake oil pressure supplied to the wheel cylinders 22a and 22b corresponding to the rear wheel which abnormalities generated, and the front wheel of a right-and-left opposite side.

[0097] In the above-mentioned operation gestalt, the damping force by electromotive brake gear EB was given to the right-and-left rear wheels RL and RR by carrying out drive control of the electrical motors 61a and 61b according to target damping torque F^* or target current-value I^* which calculated and said-calculated target damping torque F^* or target current-value I^* according to the control input (or operating physical force) F of a brake pedal 11. However, it does not depend for the damping force to these right-and-left rear wheels RL and RR on the damping force given to the right-and-left front wheels floor line and FR, and, now, cooperation of the fluid-pressure formula brake gear HB for the right-and-left front wheels floor line and FR, the right-and-left rear wheel RL, and the electromotive brake gear for RR is not necessarily fully achieved. By deciding the damping force to the right-and-left rear wheels RL and RR hereafter depending on the damping force to which it is given by the right-and-left front wheels floor line and FR explains the modification of the fluid-pressure formula brake gear HB for the right-and-left front wheels floor line and FR, the right-and-left rear wheel RL, and the brake gear for vehicles that made the electromotive brake gear for RR fully cooperate.

[0098] Although it is constituted as this modification is also fundamentally shown in drawing 1, while the rear wheel load sensor 88 which detects the rear wheel load W_r which acts on the right-and-left rear wheels RL and RR is connected to the electric brake controller 70 in this case, each brake oil pressure M_1 and M_2 detected by oil pressure sensors 53a and 53b is supplied. And the computer 71 of the electric brake controller 70 is replaced with drawing 3, and repeats and executes the rear wheel braking program of drawing 11 for every predetermined short time.

[0099] This rear wheel braking program execution is started at Step S120, like the case of drawing 3 mentioned above, if treading-in operation of the brake pedal 11 is not carried out, it judges with "NO" at Step S122, the current of electrical motors 61a and 61b is turned off at Step S124, and the damping force by the electric brakes 60a and 60b is made not to be given to the right-and-left rear wheels RL and RR. And this rear wheel braking program execution is once ended at Step S148.

[0100] If treading-in operation of the brake pedal 11 is carried out, it will judge with "YES" at the aforementioned step S122, and the abnormalities of the computer 71 by overrun etc. will be judged like the case where it mentions above at Step S126. If abnormalities have occurred to the computer 71, it will judge with "YES" at the aforementioned step S126, processing of Step S124 mentioned above will be performed, and this rear wheel braking program execution will once be ended at Step S148. Thereby, when abnormalities occur to a computer 71, even if treading-in operation of the brake pedal 11 is carried out, the damping force by the electric brakes 60a and 60b is not given to the right-and-left rear wheels RL and RR, but aggravation of the rolling-stock-run stability by grant of the mistaken damping force is prevented. In addition, about the point that vehicles are braked by the damping force of the right-and-left front wheels floor line and FR by fluid-pressure formula brake gear HB in this case, it is the same as the case of the above-mentioned operation gestalt.

[0101] On the other hand, if abnormalities have not occurred to a computer 71, while judging with "NO" at the aforementioned step S126 and inputting the brake oil pressure MP_1 and MP_2 in both liquid room 23a of a tandem piston 23, and 23b from oil pressure sensors 53a and 53b at Step S128, the rear wheel load W_r is inputted from the rear wheel load sensor 88. Next, it judges whether the braking torque sensors 82a and 82b are normal like the above-mentioned case at

Step S130.

[0102] If the braking torque sensors 82a and 82b are normal, it will judge with "YES" at Step S130, and a program will be advanced after Step S132. calculating the average of the brake pressure MP1 and MP2 which carried out [aforementioned] the input in Step S132 -- master cylinder ** MP ($= (MP1+MP2)/2$) -- derivation -- with reference to the damping torque table memorized by ROM, target damping torque T* corresponding to master cylinder ** MP and the rear wheel load Wr of a tandem piston 23 is calculated the back the bottom A damping torque table specifies target damping torque T* to master cylinder ** MP to the various sizes of the rear wheel load Wr, as a solid line shows to the graph of drawing 12 . In this case, master cylinder ** MP corresponds to the damping force of the right-and-left front wheels floor line and FR, and on the other hand, target damping torque T* corresponds to the damping force of the right-and-left rear wheels RL and RR, and it makes the graph of drawing 12 correspond to the ideal braking force distribution of an order ring. Therefore, target damping torque T* of the right-and-left rear wheels RL and RR which followed the ideal braking force distribution to the treading-in control input (or operating physical force) F of a brake pedal 11 by processing of the aforementioned step S132 is determined.

[0103] It judges whether abnormalities have occurred in the wheel speed sensors 83a and 83b like the above-mentioned case at Step S134 after processing of the aforementioned step S132. If abnormalities have not occurred in the wheel speed sensors 83a and 83b, it judges with "NO" at the aforementioned step S134, and a program is advanced to Step S138. If abnormalities have occurred in the wheel speed sensors 83a and 83b, it will judge with "YES" at the aforementioned step S134, the multiplication of the value (1-alpha) beforehand decided to be target damping torque T* which made [aforementioned] a decision at Step S136 will be carried out, and target damping torque T* will be changed into a value (1-alpha) and T*, alpha is a positive small predetermined value, and in [value / which was determined by the aforementioned step S132] this case, target damping torque T* is changed into a small value a little, as a dashed line shows to drawing 12 .

[0104] After the determination of aforementioned target damping torque T*, or change, the electric motors 61a and 61b are controlled by Step S138 so that the damping torque of the right-and-left rear wheels RL and RR by the electric brakes 60a and 60b becomes target damping torque T* changed [which was changed and above-determined] like the case of the above-mentioned operation gestalt. In addition, this control is equivalent to control of block B-2s other than block B1 of drawing 4 , B3, etc. And this rear wheel braking program is once ended at Step S148.

[0105] On the other hand, if abnormalities have occurred in the braking torque sensors 82a and 82b, it will judge with "NO" at Step S130, and a program will be advanced after Step S140. In Step S140, target current-value I* corresponding to same master cylinder ** MP as the above and a case ($= (MP1+MP2)/2$) and the rear wheel load Wr is calculated with reference to the current table memorized by ROM. A current table specifies target current-value I* to master cylinder ** MP to the various sizes of the rear wheel load Wr, as shown in the graph of drawing 13 . And although the graph of drawing 13 is also made to correspond to the ideal braking force distribution of an order ring, in order to avoid the lock of the right-and-left rear wheels RL and RR by the fall of control precision in this case, it is good [a graph] to set up target current-value I* small somewhat from what is determined with the ideal braking force distribution of an order ring. Therefore, target current-value I* of the right-and-left rear wheels RL and RR which followed the ideal braking force distribution to the control input (or operating physical force) F of a brake pedal 11 by processing of the aforementioned step S140 is determined.

[0106] After processing of the aforementioned step S140, if abnormalities have occurred in the wheel speed sensors 83a and 83b by processing of the aforementioned steps S134 and S136, and processing of the same steps S142 and S144, target current-value I* will be somewhat changed into small value (1-alpha) and I* rather than the value determined by the aforementioned step S140, as a dashed line shows to drawing 13 . If abnormalities have not occurred in the wheel speed sensors 83a and 83b, target current-value I* is maintained at the value determined by the aforementioned step S140.

[0107] After the determination of aforementioned target current-value I^* , or change, like the case of the above-mentioned operation gestalt, these motors 61a and 61b are controlled by Step S146 so that current equal to electrical motors 61a and 61b to target current-value I^* flows. Thereby, the electric brakes 60a and 60b generate the actuation load corresponding to target current-value I^* , and the right-and-left rear wheels RL and RR are braked with the damping force corresponding to the aforementioned actuation load. In addition, this control is equivalent to control of the blocks B12 and B13 of those other than block B11 of drawing 5 etc. And this rear wheel braking program is once ended at Step S148. In addition, the feedback control of an actual-current value is omitted and you may make it control the damping force of the right-and-left rear wheels RL and RR only by feedforward control like the case where it mentions above also in this case.

[0108] As a result of controlling the damping force of the right-and-left rear wheels RL and RR by the rear wheel braking program of this drawing 11, by the torque feedback control of Steps S132-S138 The damping force of the right-and-left rear wheels RL and RR is controlled according to the ideal braking force distribution of an order ring, namely, it is controlled by the basis with cooperation with the damping force of the right-and-left front wheels floor line and FR, and the situation which causes aggravation of the rolling-stock-run stability by the lock of the right-and-left rear wheels RL and RR etc. can be avoided beforehand. Moreover, since cooperative control with the aforementioned right-and-left front wheels floor line and FR is realized by the current control which consists of step S140-146 when abnormalities occur in the braking torque sensors 82a and 82b, the lock of the right-and-left rear wheels RL and RR is avoidable like the case of torque feedback control.

[0109] Moreover, when abnormalities occur in the wheel speed sensors 83a and 83b, target damping torque T^* or target current-value I^* is lowered by processing of the aforementioned steps S134, S136, S142, and S144. That is, the control gain of the electric brakes 60a and 60b to the control input (or operating physical force) F of a brake pedal 11 is lowered. Therefore, in the state where the lock of the right-and-left rear wheels RL and RR by the anti-lock brake control (ABS control) which abnormalities do not generate and illustrate in the wheel speed sensors 83a and 83b is not avoided, the braking force distribution to the right-and-left front wheels floor line and FR of the right-and-left rear wheels RL and RR is lowered beforehand, the lock of the right-and-left rear wheels RL and RR is prevented beforehand, and rolling-stock-run stability is kept good.

[0110] Moreover, in this modification, although the case where abnormalities occurred to the fluid-pressure formula brake gear HB for the right-and-left front wheels floor line and FR was not explained, also in the case of this modification, it is good to make it make the braking force distribution to the right-and-left front wheels floor line and FR of the right-and-left rear wheels RL and RR increase at the time of the abnormalities of the aforementioned fluid-pressure formula brake gear. In this case, it is made only for the specified quantity to make target current-value I^* determined by processing of target damping torque T^* determined at the aforementioned step S132, and Step S140 increase. moreover, under the situation that abnormalities occur for one hydraulic brake system of the right-and-left front wheels floor line and FR, and damping force is not given only to one front wheel like the case of the above-mentioned operation gestalt the side which abnormalities have generated, and right and left, while making the damping force of the right-and-left rear wheels RL and RR of the same side increase It is good to decrease or lose the damping force of the right-and-left rear wheels RL and RR of a right-and-left opposite side, namely, to change the braking force distribution of the right-and-left rear wheels RL and RR, and for the damping force of the wheel of a diagonal position to mainly brake vehicles.

[0111] Moreover, also in this modification, when abnormalities occur in the right-and-left rear wheels RL and RR, the point which controls the damping force of the right-and-left front wheels floor line and FR is the same as the case where it mentions above.

[0112] Since electromotive brake gear EB was applied to the right-and-left rear wheels RL and RR like the above-mentioned operation form and a modification while applying fluid-pressure formula brake gear HB to the right-and-left front wheels floor line and FR, also at the time of

the abnormalities of a hydraulic system, also at the time of the abnormalities of electric system, one of damping force can be used, vehicles can be stopped now, and rolling-stock-run stability is secured good. moreover, each fault of both the brake gears HB and EB, such as response delay fluid-pressure formula brake gear HB [at the time of low temperature], is mutual by adoption of both fluid-pressure formula brake gear HB and electromotive brake gear EB — it is compensated and the damping characteristic of good vehicles can be obtained

[0113] In addition, while applying electromotive brake gear EB to the right-and-left front wheels floor line and FR, you may make it apply fluid-pressure formula brake gear HB to the right-and-left rear wheels RL and RR conversely in the above-mentioned operation form and a modification, although electromotive brake gear EB was applied to the right-and-left rear wheels RL and RR while applying fluid-pressure formula brake gear HB to the right-and-left front wheels floor line and FR. When abnormalities occur to fluid-pressure formula brake gear HB also in this case and the damping force of the right-and-left rear wheels RL and RR decreases The damping force of the right-and-left front wheels floor line and FR is raised by controlling electromotive brake gear EB electrically. That is, it is good to compensate with the damping force of the right-and-left front wheels floor line and FR the damping force of the right-and-left rear wheels RL and RR which were made to increase the braking force distribution to the right-and-left rear wheels RL and RR of the right-and-left front wheels floor line and FR, and ran short. Thereby, according to treading-in operation of a brake pedal 11, vehicles can be exactly stopped now.

[0114] Moreover, when abnormalities occur only in one side of the right-and-left rear wheels RL and RR of the fluid-pressure formula brake gear HB and one damping force of the right-and-left rear wheels RL and RR is insufficient the rear wheel which these abnormalities generated, and right and left, while making the damping force by electromotive brake gear EB of the front wheel of the same side increase It is good to decrease or lose the damping force by electromotive brake gear EB of the front wheel of a right-and-left opposite side, namely, to change the braking force distribution of the right-and-left front wheels floor line and FR, and for the damping force of the wheel of a diagonal position to mainly brake vehicles. Thereby, like the case where it mentions above, generating of the angular moment of the vehicles by damping force can be suppressed, and rolling-stock-run stability becomes good.

[0115] Moreover, this electromotive brake gear EB is also set in the modification applied to the right-and-left front wheels floor line and FR. When abnormalities occur by the abnormalities of electric system only in one side of the right-and-left front wheels floor line and FR and it is lost [the damping force of the wheel of the method of the same was insufficient or] It is good to control the brake gear of the fluid-pressure formula of the right-and-left rear wheels RL and RR, and to decrease or lose the damping force of the front wheel which abnormalities generated, and the rear wheel of a right-and-left opposite side, namely, to change the braking force distribution of the right-and-left rear wheels RL and RR, and for the damping force of the wheel of a diagonal position to mainly brake vehicles.

[0116] Furthermore, while applying fluid-pressure formula brake gear HB to the forward left ring floor line and the right rear ring RR in operation of this invention, electromotive brake gear EB may be applied to the forward right ring FR and the left rear ring RL, or while applying fluid-pressure formula brake gear HB to the forward right ring FR and the left rear ring RL, you may apply electromotive brake gear EB to the forward left ring floor line and the right rear ring RR. That is, you may make it apply fluid-pressure formula brake gear HB and electromotive brake gear EB to "tucking up your sleeves with a cord (letter of a cross)" to the right-and-left front wheels floor line and FR and the right-and-left rear wheels RL and RR.

[0117] Moreover, this invention is applied to a truck, a trailer (tow tractor), etc. which have many wheels rather than four wheels like the six above flowers and eight flowers. While applying fluid-pressure formula brake gear HB to some wheels of two or more wheels also in this case, it is good to apply electromotive brake gear EB to a remaining part or all remaining wheels. And when applying this invention to a trailer (tow tractor) etc., as electromotive brake gear EB is applied about the wheel which separates distantly [master cylinder] and is located, it is good for damping force grant to make it the delay by piping not pose a problem.

[Translation done.]